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inductance $M_{n,k}$ is established in the magnet assembly 200. By adjusting the turns ration, N_n / N_k, between the second set of secondary coil positive turns 228, 230 and the primary coil negative turns 206, 208, as well as adjusting the turns ration, N_m / N_j, between the first set of secondary coil positive turns 220, 222, 224, 226 and the primary coil positive turns 210, 212, 214, 216, as well as varying the positions of the primary and secondary coil positive and negative turns, an optimized (e.g., minimized) mutual inductance, M, can be found whereby the secondary coil is non-coupling with respect to the primary coil. As an example of the turns ratios, N_n / N_k and N_m / N_j,

$$N_n / N_k = N_{228} / N_{206} = N_{230} / N_{208} = 2.3/100 \quad (1)$$

$$N_m / N_j = (N_{220} + N_{222})/(N_{214} + N_{210} + N_{202}) = 0.5/100 \quad (2)$$

$$= (N_{224} + N_{226})/(N_{216} + N_{212} + N_{204}) \quad (3)$$

$$N_m / N_j = N_{222} / N_{210} = N_{226} / N_{212} = 1.8/100 \quad (4)$$

$$N_m / N_j = N_{220} / N_{214} = N_{224} / N_{216} = 0.6/100 \quad (5)$$

[0029] In optimizing the mutual inductance, M, certain parameters are considered, such as shielding factor, f_s, current coupled per year, annual homogeneity change and compensated drift. The shielding factor, f_s, is a dimensionless quantity expressed as a percentage. An example specification for this would be a shielding factor of between 97.5% and 102.5%. Overshielding (f_s > 100%) is acceptable because it is the magnitude of change that is of interested, not the sign. This means the shift in the magnet field in the bore 234 due to a disturbance a certain distance away from the MRI machine is only 2.5% of that in free space at the same distance from the disturbance. The purpose of the B_0 coil is to shield the magnetic field in the imaging volume from such external effects. The design is optimized to achieve the highest possible shielding factor. The current coupled per year is the change in the secondary coil current, for a given rate of decay of current in the primary coil (e.g., 0.1 ppm/hr) expressed in Amps/year. A target value of the current coupled per year would be <0.5 Amps/year. A coupling B_0 coil needs to be dumped periodically which

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